Vol. 30. Pts. 9–10. Pp. 113–140. 45 figs. 7th November, 1961

THE PROCEEDINGS
OF THE
ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

Series B

TAXONOMY

World List abbreviation: *Proc. R. ent. Soc. Lond.* (B)

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LONDON

PUBLISHED BY THE SOCIETY AND

SOLD AT ITS ROOMS, 41, QUEEN'S GATE, S.W.7.

Price 9s. 6d.

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CONSIDERATIONS ON THE GENERA *ENDECATOMUS* MELLIÉ AND *EUDERIA* BROUN (COLEOPTERA : BOSTRYCHIDAE), WITH DESCRIPTIONS OF THEIR LARVAE

By R. A. Crowson

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Introduction

The monotypic genus *Euderia* Broun (type *E. squamosa* Broun) is doubtless the most interesting Bostrychoid beetle in the New Zealand fauna. It was referred by the original describer to the Anobiidae, but Lesne (1934) pointed out its essentially Bostrychid nature, while drawing attention to its peculiar and possibly primitive features. *Endecatomus* (amended to *Hendecatomus* by many writers) was originally referred to the Cucujoid family Cisidae, and first transferred to Bostrychidae by Leconte (1861). The larva of neither genus has been described hitherto, though their characters might be expected to throw light on the basic characters and relationships of the Bostrychidae. The description of both larval types provides a good basis for a reconsideration of phylogeny and classification in the family.

Materials

Of *Endecatomus*, I have studied dried adults of *E. reticulatus* Hbst. in the Armitage collection, Glasgow University, also a larva together with a reared adult of *E. rugosus* Randall, lent me from the U.S. National Museum, Washington by courtesy of W. H. Anderson. Larvae of *Euderia* were collected by myself in numbers in the Nelson area of New Zealand ; Mr. E. S. Gourlay of the Entomology Division of the New Zealand Department of Scientific and Industrial Research kindly presented an adult, a pupa and further larvae collected by himself in the same area.

Habits and Distribution of *Euderia*

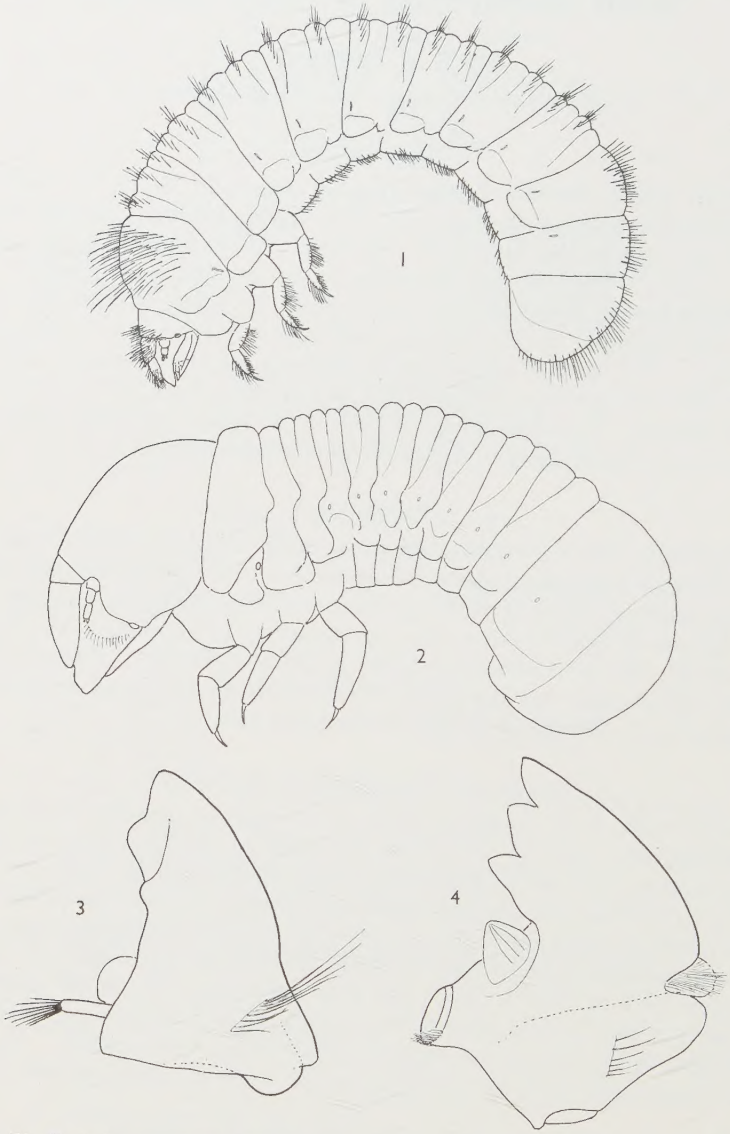
According to Mr. E. S. Gourlay, adults of *Euderia* are usually found by beating *Nothofagus* branches, but not on flowers, generally in the early part of the summer (chiefly November and early December), their reputed rarity being probably the result of short adult life and retiring habits. The larvae were found in rather indistinct galleries in moist or sappy bark of dead, or injured living *Nothofagus* trees (or in one instance, in a damaged living trunk of Rimu, *Dacrydium cupressinum*) ; dates range from January 23rd to March 7th in my own collecting. Mr. E. S. Gourlay found larvae, a pupa in its cell, and a newly emerged adult in a similar cell, under bark of dead *Nothofagus* in the Pelorus reserve near Nelson in November, 1958. The available evidence is insufficient to decide whether the life cycle takes one or several years.

Habits and Distribution of *Endecatomus*

There are four known species of *Endecatomus*—*E. rugosus* Randall from the U.S.A. east of the Rocky Mountains, *E. dorsalis* Mellié from the southern part of the U.S.A., *E. lanatus* Lesne from the far east of the Palaearctic region, and *E. reticulatus* Hbst. from central and southern Europe. The last mentioned species appears to be particularly attached to the fungus *Polyporus betulinus* on dead Birch (*Betula*), but may occur also in other *Polyporus* species ; *E. rugosus* is reported by Fisher as bred from *Polyporus gilvus* (an unusually hard and *Fomes*-like species) The larva examined by me was associated with an adult of *E. rugosus* (determined by Fisher's key and description) and labelled " from fungus on Birch log ".

Description of Larva of *Euderia squamosa* Broun (figs. 1, 3, 5, 7)

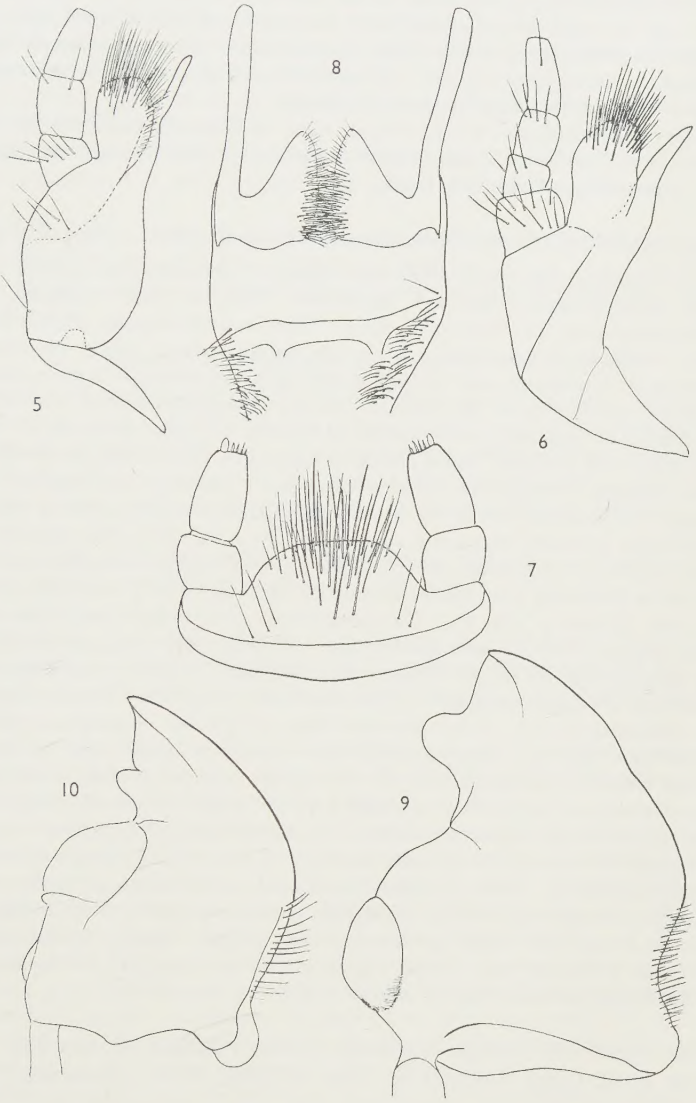
Body form typically Bostrychoid—soft, white and c-shaped with retracted prognathous head and well-developed legs. Head capsule pigmented only on its narrow exposed anterior margins, particularly around mandibular articulations ; a median dorsal suture extending nearly its whole



Figs. 1–4.—(1) *Euderia squamosa* Broun, larva. (2) *Endecatomus rugosus* Rand., larva. (3) *Euderia* larva, left mandible, ventral view. (4) *Endecatomus* larva, right mandible, dorsal view.

length but no discernible frontal sutures. Clypeus very short, with a transverse setal fringe narrowly interrupted in the middle, epistoma with a similar more widely interrupted fringe along its anterior margin. Labrum large, triangular, with broadly rounded angles, its upper surface densely setose in the front part, setae becoming sparser posteriorly. Ocellus represented by a convex cuticular lens and underlying pigment spot, immediately behind lower articulation of mandible. Epipharyngeal rods small, attached to posterior half of labrum, not distinctly hooked. Antennae 3-segmented, segment 1 short and strongly transverse, segment 2 slightly narrower than

1 and almost as long as wide, bearing a small peg-like appendage at its apex ventrally to segment 3, latter slightly elongate, about one-third as wide as 2 and scarcely longer than 1. Mandibles not very acute at apex, with 2 rather obtuse teeth before apex of their inner face, and an elongate articulated appendage, with a setal brush at its apex (fig. 3), near base of inner face. Maxillae with 3-segmented palpi, palpifer hardly distinct (fig. 5), segment 1 of palp shortest; lacinia



FIGS. 5–10.—(5–6) Right maxilla, ventral view, of: (5) *Euderia* larva; (6) *Endecatomus* larva. (7) *Euderia* larva, prementum, ventral view. (8) *Endecatomus* larva, hypopharyngeal sclerotisation, dorsal view. (9) *Euderia* adult, right mandible, dorsal view. (10) *Endecatomus* adult, left mandible, ventral view.

elongate, spur-like. Labium with broad obtuse ligula and well-developed premental sclerite (fig. 7), palpi 2-segmented, segment 2 longer than 1. Hypopharynx without marked sclerotisations. Prothorax with very light but distinguishable median notal sclerotisation but no lateral rod-like thickenings, spiracles situated postero-laterally. Meso- and meta-thorax with 3 transverse notal folds each, each fold bearing a line of short setae. Legs without distinct trochanters, femora with vestiture of long setae, tibiae bearing numerous short darkly pigmented

spines, tarsungulus long, slender and only slightly curved, without setae. Abdominal segments 1–6 with 4 transverse notal folds each, first and third fold of each notum with conspicuous band of setae, which are slightly longer on the anterior setiferous fold of each segment. Division of notum indistinct on segment 7, disappearing altogether on segments 8 and 9, where the setae become longer and more generally distributed. Anus situated ventrally, in a longitudinal slit, tenth segment containing it produced anteriorly into a ventral emargination of segment 9; front end of longitudinal slit partly embraced by the arms of a V-shaped pigmented sclerite, which internally gives rise to a pair of sclerotised rods running along wall of hind gut. Abdominal spiracles all similar in size, slightly smaller than the prothoracic ones, occurring on segments 1–8, above the conspicuous setose pleural lobes. All spiracles very elongate dorso-ventrally, openings showing a sinuous dorsal extension as in many Anobiidae.

The largest larvae collected had a body length, when extended to the degree of the specimen figured, of rather more than 5 mm.; the smallest were of about half these linear dimensions and would probably represent the 2nd or 3rd instar.

Description of Larva of *Endecatomus rugosus* Randall (figs. 2, 4, 6, 8)

Body form Anobiid-like, fleshy and white with c-shaped curvature, head capsule exserted and mouth directed anteroventrally, legs well developed. Hairs of body vestiture considerably longer and more conspicuous than those of *Euderia*. Head capsule elongate, lightly but distinctly pigmented, with vestiture of long setae all over its dorsal surface, darkly pigmented along a narrow anterior strip of epistoma and around mandibular articulations, a more extensive dark area behind ventral condyle near the ocellus. Median dorsal suture well marked, extending nearly to front margin of epistoma, no visible frontal sutures. Clypeus rather short, labrum large, somewhat triangular with rounded angles, about as long as its basal width, setal vestiture dense towards its front margin. Ocellus as in *Euderia squamosa*. Antennae with segment 1 transverse, 2 slightly narrower and distinctly elongate, bearing at its apex 2 small processes, the more dorsal and smaller of which probably represents segment 3, the other being the sensory appendage. Mandibles large and stout, apex rather sharp, with 2 more sub-apical teeth forming a series of 3; a large membranous prostheca just behind middle of inner face and a well-developed molar (or pseudo-molar) area behind it (fig. 4). The pseudomola with rather gouge-like cutting edge, posterior (basal) margin of which has a setal fringe. Maxillae with 4-segmented palpi and some indication of a palpiger (fig. 6), lacinia elongate and spur-like. Labium with 2-segmented palpi, segment 1 transverse, 2 slightly elongate; ligula broad and obtuse with densely setose upper and lower surfaces, premental sclerite rather narrower than in *Euderia*. Hypopharynx with characteristic sclerotisations (fig. 8). Epipharyngeal rods relatively larger than in *Euderia*, more anteriorly placed and very distinctly hooked. Prothorax without evident notal sclerotisation, meso- and meta-thorax and abdominal segments 1–7 each with 2 transverse tergal folds bearing bands of setae, which become relatively longer on posterior part of abdomen. Legs with well-marked trochanters, femora and tibiae with vestiture of rather long slender setae, tarsungulus less slender than in *Euderia*. Thoracic spiracles situated in posterolateral border of prothorax, abdominal spiracles situated near middle of segments, above pleural protuberances of segments 1–8. All spiracles simple and ovate, prothoracic ones largest, those of abdominal segment 1 slightly larger than following ones. Anal region somewhat damaged in the single available specimen but apparently not showing a V-shaped sclerite on sternite 10.

Description based on a single specimen, rather contracted, labelled " ex fungus on dead Birch, Rock Creek Park, D.C. Dec. 9, 1939, W. H. Anderson ".

Key to Subfamilies of Bostrychid Larvae

(in part adapted from Anderson (1939))

1 Head fully exserted, Anobiid-like, with long setae over its whole dorsal surface; mandibles with a dorsal mola-like process (pseudomola) bearing a setal fringe around part of its edge; abdominal terga 1–5 with only 2 transverse folds; maxillary palpi with 4, labial palpi with 2 well-developed segments; all spiracles simple and oval; body with unusually long setal vestiture; living in bracket fungi . . . . . 1. Endecatominae

– Head capsule deeply retracted, setae present only on its narrow exposed anterior part 2

2 Mandibles with a well-developed pseudomola ; basal abdominal tergites often with 2 transverse folds ; prothorax never with oblique lateral sclerotised rods 3
– Mandibles without pseudomola ; basal abdominal tergites with 3–4 transverse folds ; prothorax nearly always with oblique lateral sclerotised rods 6
3 Labial palpi with only 1 distinct segment in addition to the palpifer ; abdominal terga 1–5 with 2 transverse folds 4
– Labial palpi with 2 distinct segments in addition to palpifer 5
4 Last abdominal spiracle not larger than preceding ones ; prementum transverse, its sclerite not escutcheon-like . . . . . 2. Dinoderinae
– Last abdominal spiracle much larger than preceding ones, premental sclerite more or less escutcheon-like . . . . . 3. Lyctinae
5 Abdominal terga 1–5 with 2 transverse folds ; ocellus distinct . 4. Dysidinae
– Abdominal terga 1–5 with 3 transverse folds ; ocellus not distinct 5. Psoinae
6 Prothorax without oblique sclerotised rods ; ocellus well developed ; spiracles with dorsal prolongations as in many Anobiidae . . . . 6. Euderinae
– Prothorax with oblique lateral sclerotised rods ; ocellus not distinct ; spiracles simple, oval . . . . . 7. Bostrychinae

Key to Subfamilies of Bostrychid Adults

1 Prothorax with well-marked toothed and explanate side edges ; middle coxal cavities not fully closed by sterna ; wings with 5 anal veins in main group. Antennae 11-segmented with short nearly symmetrical 3-segmented club ; mandibles with well developed molar part (pseudomola) ; ligula almost entire, without distinct paraglossae, gular sutures widely separated ; front tibiae with only 1 spur . . . . . 1. Endecatominae
– Prothorax with side edges absent or very weak ; middle coxal cavities almost always closed outwardly by sterna ; wings with never more than 4 anal veins in main group 2
2 Tarsal segment 5 at least as long as 1–4 together, 1 shorter than 2 but not many times so ; wing-venation reduced, without closed radial or anal cells ; segments of antennal club not or slightly elongate ; front tibiae with only 1 spur 3
– Tarsi with last segment shorter than previous ones together, segment 1 often much shorter than 2 ; wings usually with closed radial and anal cells ; segments of antennal club usually longer than wide 4
3 Front coxae distinctly projecting, prosternal process obsolete between them ; general form cylindrical, not very elongate, prothorax of markedly Bostrychoid shape ; antennae 10–11 segmented with 3-segmented club ; mandibles with pseudomola well developed, labrum large and deflexed at an angle with clypeus ; gular sutures confluent posteriorly . 2. Dinoderinae
– Front coxae not projecting, separated by a more or less distinct prosternal process ; general form very elongate, rather flat, prothorax not of markedly Bostrychoid shape ; antennae 11-segmented with (2- rarely 3-) segmented club ; pseudomola absent or poorly developed, labrum small, in same plane as clypeus ; gular sutures separate throughout . . . . . 3. Lyctinae
4 Head freely exposed from dorsal view, prothorax only weakly Bostrychoid in shape, notum without pronounced tubercles or processes 5
– Head largely hidden from dorsal view, prothorax strongly Bostrychoid in form, notum often produced into processes or tubercles 6
5 Tarsi 5-segmented with segment 1 at least half as long as 2. Mandibles without pseudomola ; ligula without paraglossae ; gular sutures widely separated ; front tibiae with 2 distinct spurs ; antennae 9–10 segmented 4. Dysidinae
– Tarsi with segment 1 many times shorter than 2, or 4-segmented 5. (Psoinae) 5*a*
5*a* Gular sutures confluent posteriorly ; tarsal segment 1 small but distinct ; antennae 10–11-segmented . . . . . Polycaonini
– Gular sutures quite separate ; tarsi 4-segmented ; antennae 9–10-segmented Psoini

6 Tarsi with segment 1 longer than 2 ; trochanters elongate, Anobiid-like ; gular sutures widely separated ; mandibles with pseudomola and membranous prostheca . . . . . 6. Euderiinae

– Tarsi with segment 1 much shorter than 2 ; trochanters short, normal ; gular sutures fused posteriorly ; prostheca absent, pseudomola often absent also 7. Bostrychinae

Note on the Larval Characterisation of Bostrychidae

Nearly all larval keys hitherto published have relied mainly on the retracted head-capsule as a method of distinguishing Bostrychid larvae from those of Anobiidae and Ptinidae. If *Endecatomus* is to be retained in the Bostrychidae, the larval definition of the family will have to be amended. The antennae offer perhaps the most obvious character which could be used for this purpose—in all known Bostrychid larvae, there are three distinct antennal segments, the second of which bears the usual sensory appendage as well as the (often minute) third segment. No known Anobiid or Ptinid larva has more than two distinct antennal segments, the first of which bears the sensory appendage.

The Relationships of *Endecatomus* and *Euderia*

Evidence has been presented elsewhere for a derivation of the Bostrychoidea from Dermestoid ancestors rather near the family Dermestidae (van Emden, 1951 ; Crowson, 1955, 1960). Accepting this, we might expect the most primitive types of Bostrychoidea to be those showing the greatest similarity to Dermestoidea, and particularly to primitive Dermestids ; by this criterion, *Endecatomus* deserves very special prominence. The adult of the genus has more Dermestid-like wing-venation and antennae than any other known Bostrychoid, it has a mandibular mola (or pseudomola) very like that of the primitive Dermestid *Orphilus*, its middle coxal cavities are not closed outwardly by the sterna ; the *Endecatomus* larva has a hypopharyngeal sclerome (fig. 8) more like that of *Dermestes* than is that of any other Bostrychoid I have seen, and in combining an exserted head-capsule with 3-segmented antennae it differs from all other known Bostrychoids but resembles Dermestoids. On the other hand it must be pointed out that the adult *Endecatomus* has more or less flat hind coxae like other Bostrychids, that its aedeagus is less obviously Dermestid-like than that of *Lyctus*, and that it has a characteristically Bostrychoid met-endosternite. The exserted head-capsule seems to be the only respect in which the *Endecatomus* larva is more Anobiid-like than other Bostrychids, and there are reasons for doubting whether this character is primitive—it might well be correlated with the special mode of life of this larva. A possible parallel is in the Curculionoidea, where Apionid and Curculionid (*s. str.*) larvae show similarly exserted head-capsules but seem to be derivable from Attelabid-like larvae with retracted head-capsules.

Euderia, on the other hand, could be described as the most Anobiid-like of Bostrychids, and shows little or no special similarity to Dermestoidea. The hind coxae of the adult, for example, are less flat than those of *Endecatomus* and seem to be rather transitional to the semi-excavate types found in such Anobiids as *Eucrada*. The long trochanters and basal tarsal segments are Anobiid-like characters found in no other known Bostrychidae. The most Anobiid-like feature of the *Euderia* larva is its type of spiracle. If the exserted head-capsule of Anobiid larvae can be taken as secondary (as we have already suggested it may be in *Endecatomus*), it would seem possible to imagine Anobiidae to have come from Bostrychid ancestors akin to *Euderia*. Objections might perhaps be raised on account of the antennae, which in seemingly primitive Anobiids like *Eucrada* and *Hedobia*, as also in Ptinidae, are 11-segmented and filiform whereas in *Euderia* they are 10-segmented (as in Bostrychinae) and strongly clubbed (as in all Bostrychidae). Is it possible that such a strong differentiation of the apical segments could be obliterated in the course of evolution? Something like this seems

to have happened in Dermestidae (in the case of *Thylodrias*), also in the ancestry of Staphylinidae (all the most primitive-seeming Staphylinoids have strongly clubbed antennae), probably also in the Melyrid line, and perhaps within the Heteromera. If the theory just outlined were adopted, a radical reorganisation of our classification of Bostrychoidea would be needed in order to make it comply with the canons of Hennig's (1950) phylogenetic taxonomy. *Endecatomus* would certainly have to be placed in a family of its own, and the rest of the old Bostrychidae would probably be split into three more families—an enlarged Lyctidae to include Dinoderinae, Psoidae to include Dysidinae, and Bostrychidae with Euderiinae and Bostrychinae—side by side with the old Anobiidae and Ptinidae. If this proposal is thought to savour too much of splitting, the only practicable alternative consistent with the postulated phylogeny would be to have only two families, Endecatomidae and Bostrychidae—the latter to include all the Bostrychoidea except *Endecatomus*. This latter proposal would be likely to meet even more objections than the first; in view of the uncertainty of the implied phylogeny it seems premature to introduce either of them.

An alternative view which might be considered would be that *Euderia* represents the most primitive surviving Bostrychid type, as was suggested by Lesne (1934, 1938); *Endecatomus* might then be regarded as a primitive member of the Lyctinae-Dinoderinae line, and Anobiidae-Ptinidae as collateral relatives of Bostrychidae. On this theory the excavate hind coxae of typical Anobiids could be a primitive feature carried over from Dermestoid ancestors—but the difficulty about the antennae would still remain, as all known Dermestoids (except *Thylodrias*) have clubbed antennae. If the mandibular mola (or pseudomola) of Bostrychid adults and larvae is regarded as a derivative character, then we might postulate for the ancestral Bostrychoids mandibles very much like those of *Dermestes* (or Thoractidae), both in the adult and the larva. On this theory the Bostrychoids might be derivable from Dermestidae *s. str.*, and a strict phylogenetic classification might require the transference of Dermestidae and Thorictidae to the Bostrychoidea.

Whichever (if either) of these theories is ultimately adopted, there can be little doubt that *Euderia* is related to Bostrychinae more closely than to any other group, and it seems highly probable that it is to be regarded as a relict survival of a group from which the Bostrychinae were derived; outside the Bostrychinae, its greatest similarity is probably to the Dysidinae-Psoinae group. *Endecatomus* would certainly seem to have a better claim to a family of its own than Lyctidae, and would appear to be closest to the Dinoderinae-Lyctinae group.

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Book Notices

Bulletin of the California Insect Survey. Vol. 6, No. 6. The Stoneflies (Plecoptera) of California. By S. G. Jewett, Jr. Pp. 125–77 : 1 plate, 41 figures. 4to. Berkeleyand Los Angeles (University of California Press), 1960. $1.25.

The above work is among the most recent additions to the California Insect Survey Bulletins. In the present work 101 species are recorded for California, of which 73 occur also in Oregon and 60 in British Columbia.

General notes on the developmental stages, the characters used in classification and methods of preservation and collection are given. Most of the work is devoted to keys to the families and genera of the nymphs and adults and of the subgenera and species ; a table of the county records, an index to the genera and species and a list of references are included.

British Flies. Vol. VI. *Empididae.* By J. E. Collin. Part 1. *Tachydrominae.* Pp. viii, 1–219, 73 text-figs. 30s. Part 2. *Hybotinae, Empidinae* (*except* Hilara) Pp. 223–551, 131 text-figs. 30s. 8vo. Cambridge University Press, 1961.

These works are the first two of three separately published, but continuously paged, parts of a work on the British species of Empididae, which together with the other part will form volume six of the series *British Flies* inaugurated by the late G. H. Verrall.

Of the 354 species of Empididae at present recorded in Britain, 117 have been described from British specimens, while the original typical specimens of 122 other species have been examined and in each case compared with British specimens in order to ensure, within reasonable limits, that their identification is correct. All generic and subgeneric divisions are numbered successively throughout the volume, and the species successively throughout each division.

The first part contains a classification of the Empididae, with a table of the subfamilies and a short table of the British genera, and in it nine genera of the Tachydrominae are described. The second part deals with sixteen genera of the Hybotinae and seventeen genera of the Empidinae.

A REMARKABLE NEW PHLEBOTOMINE SANDFLY (DIPTERA: PSYCHODIDAE) FROM IRAN

By D. J. Lewis

(*Scientific staff, Medical Research Council; care of British Museum (Natural History)*)

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While collecting sandflies in the south of Iran (Lewis and others, 1961) we found a new species closely related to the African *Phlebotomus lesleyae* Lewis and Kirk (1946, 1951, 1954, 1957; Kirk and Lewis, 1951). A detailed examination of both species has revealed certain characters not previously detected in *P. lesleyae*, and shows that they do not belong to any existing genus or subgenus according to the present definitions.

Phlebotomus (Sergentomyia) iranicus sp. n. (fig. 1)

Female.—A3 $< 4 + 5$; A3/E = 0·55 (0·53–0·57) ($n = 5$); antennal formula 2/3–14; ascoid on 4 is about half the length of the segment; papilla formula 1/3–5. Third palpal segment 1·2 as long as fourth; fifth about twice as long as fourth. Cibarium with delicate, almost imperceptible, lateral spicules, and smaller scattered ones behind the usual position for teeth; pigmented plate small and sometimes colourless; cibarial arch narrow, but well defined, and forming an almost straight transverse line. Pharynx apparently with an anterior row of scale-like ridges, posterior lateral groups of oblique ridges, and posterior central group of blunt teeth; when the dorsal plate is separated from the other two and crushed it is seen that most of the teeth are pointed, many have minute denticles, and the posterior teeth are long. Head with a bulge behind each eye; long brown hairs conspicuous in this region in fresh specimens. Thoracic integument pale; pleura with two tufts of hairs behind spiracles; femora thick. Wing length 1·49 (1·42–1·61) mm. ($n = 5$); width 0·39 (0·36–0·42) mm.; index 0·5 (0·3–0·8). Abdominal tergites with large hair-scars; first sternite pale but well defined; eighth tergite an ill-defined brown band; terminal segments tend to be telescoped in fresh specimens, giving abdomen a blunt tip; furca Y-shaped, with narrow posterior arms; spermathecae elongated, with smooth walls, a narrow anterior knob without the usual hair-like glandular ducts (in cleared specimens), and with very short posterior ducts.

Male.—A3 $< 4 + 5$; A3/E = 0·70 (0·69–0·74) ($n = 5$); antennal formula 2/3–14; ascoid on 4 is about half as long as the segment; papilla formula 1/3–5. Third palpal segment about 1·1 as long as fourth, fifth about 2·2 as long as fourth. Cibarium as in female, pharynx with much reduced armature. Hind leg 1·8 times as long as wing (compared with 2·1 for *P. papatasi* Scop.). Wing length 1·35 (1·28–1·44) mm. ($n = 5$); width 0·34 (0·32–0·37) mm.; index 0·6 (0·4–0·7). Coxites extend laterally, rather like the claw-legs of crabs, so that mounted terminalia are seen in dorsal or ventral view; styles with five spines, of which two are terminal, two subterminal, and one, less stout than the others, in the middle. Paramere with dark tip, which is bluntly pointed in side view and sharp and curved in ventral view, and a partly flattened process with a terminal hair. Aedeagus stout with a broad base; the tips transparent and curving outward like the terminal joints of two thumbs. Genital filaments 3·9 times as long as pump, their tips like curved gutters with truncated ends; genital pump 0·6 length of coxite.

Specimens examined: Iran: Kazerun, quarries (*Lewis* and *Mesghali*), 24.vi.60, 3 ♀ (including holotype), 4 ♂; 26.vi.60, 2 ♀, 7 ♂. Holotype ♀ and paratype ♂ in British Museum (Nat. Hist.); 2 ♀ and 2 ♂ paratypes in Tehran University.

P. iranicus differs from *P. lesleyae* in having a larger A3/E value, longer ascoids, a smaller central spine on the style, a dark-tipped paramere with a differently shaped process, aedeagus and filaments with differently shaped tips, and other features. In Theodor's (1958) keys (of Palaearctic sandflies) the females of both these species would run to couplet 15 on page 36, being distinguished from the other species by the pharynx, which is neither conical nor heart-shaped and has many teeth. The males would run to couplet 12 on page 34, being distinguished from the other species by the presence of five spines on each style.

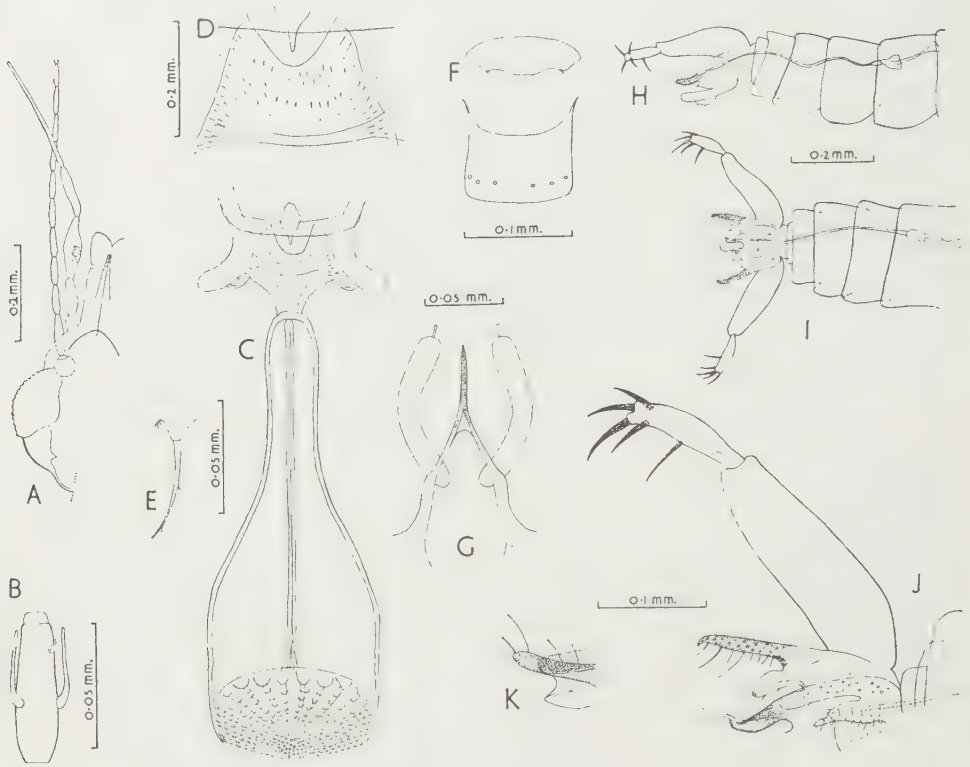

Fig. 1.—(*A–G*) *Phlebotomus iranicus* sp. n., female: (*A*) antenna, palp and labrum; (*B*) fourth antennal segment; (*C*) cibarium and pharynx; (*D*) cibarial armature; (*E*) a long tooth from pharynx; (*F*) first two abdominal sternites; (*G*) spermathecae and furca. (*H–K*) *P. iranicus*, male: (*H*, *I*) terminalia from side and below; (*J*) terminalia of one side from below (lateral lobe and cercus foreshortened); (*K*) tip of paramere and aedeagus from the side.

Systematic Position

While making use of the grouping of species in Theodor's (1958) valuable monograph of the Palaearctic Phlebotominae, we are using the old nomenclature of genera and subgenera until the classification of the Phlebotominae of the world has been more fully studied.

P. iranicus and *P. lesleyae* differ from both the old world subgenera *Phlebotomus* and *Sergentomyia*, as defined (as genera) by Theodor (1958), but appear to be more nearly related to the latter. *Sergentomyia* already includes some aberrant species, and at present it seems appropriate to widen the definition of *Sergentomyia*, in order to include the two species, rather than to create a new subgenus for them. It then becomes necessary to alter part of the section on *Sergentomyia* on page 13 of Theodor's (1958) keys as follows: " Usually one or more rows of well developed teeth . . . in

the basal part of the cibarium " ; " (1–2 long and one small spine, in one group, and 5 spines in another) ".

With regard to the position of the two species within the subgenus *Sergentomyia* we consider that, for the present at least, they should constitute a species group. the *lesleyae* group, equivalent to one of Theodor's subgenera and having the following characters:

Antennal formula 2/3–14 in females, 2/3–14 or 2/3–13, 1/14–15 in males ; papilla formula 1/3–5 in both sexes. Cibarium with very delicate spicules. Basal teeth of pharyngeal armature very long. Wing index more than 1. Pleura with two groups of hairs behind spiracle. Spermathecae smooth and elongated with small anterior knobs and very short ducts. Style with five spines. Paramere with partly flattened process. Aedeagus stout with broad base.

P. iranicus and *P. lesleyae* are not the only species which do not fit the existing definitions of any subgenera, for Abonnenc and others (1959) have pointed out the difficulty of classifying *P. darlingi* Lewis and Kirk. When the Phlebotominae are better known it will be necessary to review the postion of these species.

The discovery of *P. iranicus* may explain why *P. lesleyae* has such a very limited distribution in Africa. The group may have originated in the drier part of the Palaearctic Region from which *P. lesleyae* was probably able to spread only into the drier part of the Sudan.

Acknowledgments

Our thanks are due to the World Health Organization, the Institute of Parasitology and Malariology, Tehran, and those mentioned by Lewis and others (1961) for providing the opportunity of finding *P. iranicus*, and to Professor O. Theodor for suggestions.

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A NEW SPECIES OF HYPOGASTRURID COLLEMBOLA, *BRACHYSTOMELLA SURENDRAI* SP. N., FROM INDIA

By H. E. Goto

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A large number of specimens of an unknown species of Collembola was collected from the surface of a rain water puddle after a heavy shower in the desert belt of Rajasthan in NW. India. These specimens, sent for identification by Dr. H. L. Kundu, proved to belong to a species new to science and to a genus new to India. At the request of Dr. Kundu I have named this species *Brachystomella surendrai* after his father Professor Surendra lal Kundu.

Brachystomella surendrai sp. n.

Facies typical of the genus with all segments distinct and separate (fig. 1).

Colour : macroscopically the specimens appear dark grey-blue on dorsal surface and colourless ventrally, young specimens only slightly paler than the largest ones ; head and antennae a little darker, with a very slight reddish tinge, eye patches purple to black. Legs (with the exception of the coxae), ventral tube and furca pale. (The colour was recorded after the specimens had been fixed in Carnoy's fluid and preserved for some time in 70 per cent. alcohol.) Microscopically the pigmentation is seen to be formed of small discrete spherical epidermal granules, forming a fairly regular pattern both dorsally and ventrally, dorsal patterning consisting mainly of rather asymmetric pale areas in the intersegmental regions and in dorsal and dorsolateral segmental areas (fig. 2).

Vestiture : a rather sparse clothing of short, smooth, mostly acuminate setae both dorsally and laterally (figs. 3, 4). All macrosetae on last three abdominal segments normally distinctly clavate, especially on terminal segment, corresponding setae on the more anterior trunk segments appearing blunt-tipped (it is very difficult to decide if these are weakly clavate or not). Antennal setae arranged as in figures 5 and 6. Each prothoracic tibiotarsus normally with three clavate tenent hairs (fig. 14) (the curved seta shown in this figure is sometimes weakly clavate on the first pair of legs and frequently so on the second pair) ; hind tibiotarsi normally with four distinctly clavate setae (fig. 13) ; unguis bears a pair of lateral setae (figs. 13, 15). Ventral tube, in specimens of all ages, with three setae on either side of distal end of corpus (fig. 16) ; no seta on retinaculum. Manubrium naked anteriorly with eleven setae on either side of posterior face, arranged as in figure 22 (the basolateral group of three setae on either side is close to the junction with the ventrolateral body wall and in some specimens appears to arise in that region). (This number and arrangement was found in the smallest (0·07 mm.) as well as the largest specimens examined and probably indicates either that the earliest instars were not represented in the sample examined or that the species is somewhat unusual in this respect.) Dentes of all specimens with three setae on posterior face, arranged as in figures 19 and 20 ; no mucronal setae. Female genital setae (figs. 4, 25) typical ; in male (fig. 26) normal inner ring of genital setae modified, the four anterior setae being stout and apically lobed (these setae are never longer than about 0·01 mm. and it was not possible to determine the number or detailed structure of the apical lobes).

Cuticle : most of body surface finely granulate and each granule rugose ; anterior face of furca and adjacent sternal areas, vesicles of ventral tube, corpus of retinaculum and external face of legs covered with a minute granulation as described for *Hypogastrura gotoi* Murphy, 1960 *in* Goto (1957).

Head : eight equal-sized ocelli on either side of head (figs. 3, 7). Postantennal organ approximately equal in size to a single ocellus, normally four-lobed but rarely five- (fig. 8) or three-lobed (fig. 9) ; no accessory boss. Buccal cone fairly prominent. Mandibles completely absent. Maxilla

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Figs. 1–12.—*Brachystomella surendrai* sp. n. : (1) lateral view ; (2) dorsal colour pattern ; (3) dorsal chaetotaxy ; (4) ventral chaetotaxy ; (5) antennal chaetotaxy ; (6) apex of ant. IV ; (7) left ocelli and postantennal organ ; (8) abnormal postantennal organ with 5 vesicles ; (9) abnormal postantennal organ with 3 vesicles ; (10) labial chaetotaxy, ventral view ; (11–12) maxilla head.

head (figs. 11, 12) apically broad, with 7–9 teeth but no lamellae. Antennae shorter than head diagonal with the two distal segments partially fused together dorsally (fig. 5). Antennal organ of third segment consisting of a pair of sensillae in separate but adjacent pits without protective folds or papillae, on either side with a stout sensory seta similar to the olfactory setae, and with a small conical sensillum a little way behind and to one side of antennal organ. Terminal segment with a number of olfactory setae, many of which are difficult to distinguish from the normal setae ; apically with a large bilobed retractile organ ; subapical pit, containing a minute sensillum, present, arched over by a prominent olfactory seta ; just posterolateral to this seta is another small but superficial sensillum.

Legs : unguiculus totally absent; unguis (figs. 13, 15) with a pair of lateral teeth and a single inner tooth about half way along length of claw ; lateral teeth, but not the internal one, discernable even in the smallest specimens.

Abdomen : rami of retinaculum normally tridentate (fig. 17) but rarely bidentate (fig. 18). Furca small but well developed, normally with all its parts distinct and separate ; in one of the specimens the mucro was found to be absent (fig. 23) and in another to be much reduced (fig. 24) ; in a few cases mucrones only distinctly separated from the dentes anteriorly ; mucro about half length of dens, provided with a strong but blunt apical tooth and rounded lateral lamellae (figs. 19, 20 and 21), a few (3–4) conical cuticular granules forming a line behind the tooth. Dentes provided with well developed retinacular hooks and a lobe extending up to or just beyond base of mucro. Manubrium basally swollen, forming a distinct cone (fig. 1). Female genital aperture a typical, simple transverse opening (fig. 25) ; male pore circular, raised on a cone (fig. 26). Sex ratio very unequal ; only a few males were seen in the hundreds examined. In nearly all cases the alimentary canal was practically empty ; where food was present none of it was identifiable.

Length : maximum size, measured from mouth to anus, 1·25 mm. ; minimum length 0·01 mm.

Type locality : India : Pilani, Rajasthan. H. L. Kundu *leg.*

Type specimens : Holotype ♂, mounted in a methyl cellulose medium and ten paratypes in 70 per cent. alcohol have been deposited in the British Museum (Natural History). A further ten paratypes have been sent to the Zoological Survey of India, Calcutta.

This new species falls quite naturally into the genus *Brachystomella* Ågren, 1903 *sensu* Stach, 1949 for the following reasons : (1) the absence of mandibles, (2) the broad multidentate maxilla-head, (3) the 8 + 8 eyes, (4) the lack of an unguiculus, (5) the toothed unguis, (6) the presence of a furca, (7) the simple mucronal lamellae, (8) the absence of dental spines, (9) the complete separation between the last two abdominal segments, (10) the absence of anal spines and (11) the presence of pigmentation.

Brachystomella surendrai may easily be distinguished from the previously described species of the genus by a number of important features. It differs from all others in the possession of the abdominal clavate setae and in the presence of only three dental setae as opposed to five or six in the other members of the genus. In normal specimens the four lobes of the postantennal organ serve to eliminate all species with the exception of *agrosa* Wray, 1953, *fungicola* Womersley, 1933, *nubila* Gisin, 1957, *stachi* Mills, 1934 and *tuberculata* (Wahlgren, 1906). From these *surendrai* may be distinguished, in addition to the features mentioned above, by the presence of 3–4 distinctly clavate tibiotarsal setae and the bilobed retractile organ of the antenna. The few abnormal specimens with a five-lobed postantennal organ may be separated from the remaining species by the presence of eight ocelli on either side of the head (eliminating *B. 7-oculata*) and the presence of 3–4 clavate tibiotarsal setae.

The modified genital setae in the male have not previously been described but I hesitate to record these as features confined to *B. surendrai* because of their small size and their position (the genital area being one to which little attention has been paid) and also because of the paucity of males (approximately 1 per cent. of the sample examined) within the population—a feature which may be shared by other species of the genus.

Although the genus has a wide distribution, having been found in all six zoogeo-

FIGS. 13–26.—*Brachystomella surendrai* sp. n.: (13) unguis and apex of tibiotarsus III; (14) apex of tibiotarsus I; (15) unguis, inner view; (16) ventral tube, lateral view of apex; (17) retinaculum; (18) retinaculum with abnormal rami; (19) dens and mucro, outer lateral view; (20) dens and mucro, anterior view; (21) mucro, posterior view; (22) manubrium, chaetotaxy of posterior face; (23) dens, abnormal specimen without mucro; (24) dens with reduced mucro; (25) female genital aperture and chaetotaxy; (26) male genital aperture and chaetotaxy.

graphical regions, it has only recently been recorded from the Oriental Region, viz. : *Brachystomella contorta* Denis, 1931 by Yosil (1959) from Selangor.

I should like to thank Miss E. A. Tree for checking the chaetotaxy of some of the specimens and for help in the preparation of the illustrations.

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A NEW SPECIES OF *ANISOPS* (HEMIPTERA : NOTONECTIDAE) FROM EAST AFRICA

By I. Lansbury

(*Hope Department of Entomology, Oxford*)

The following description is based on a series of specimens collected by the author in Ethiopia and Northern Kenya. For descriptions of the other species in the genus and a detailed explanation of the terminology used in this paper *see* Brooks, G. T., 1951, A Revisio nof the genus *Anisops* (Notonectidae, Hemiptera), *Univ. Kansas Sci. Bull.* **34** : 301–519.

Anisops spinosus sp. n.

Size : male, length 6 mm., greatest body width 1–1·5 mm. ; female, length 5·5–5·75 mm., greatest body width 1–1·5 mm.

Shape : slender fusiform species, with greatest body width just behind midway of its length.

Colour : general facies stramineous ; eyes dark brown ; legs stramineous ; abdominal venter almost black with keel and segmental margins of connexivum stramineous.

Male structural characteristics : viewed from above, outline of the head rounded with anterior interocular space extended anteriorly into a short cephalic horn with apex acuminate, in which are inserted long hairs (fig. 1 *A*). Frons with two keels extending from apex to labrum. Greatest width of head nearly nine-tenths as wide as pronotal humeral and just over four times width of anterior width of vertex. Synthlipsis one-fourth of anterior width of vertex. Along median longitudinal axis, head almost same length as pronotum. Pronotal humeral width slightly less than half its median length. Lateral margins divergent and just under half its median length ; posterior margins convex, medianly emarginate. Facial tubercle slightly raised. Rostral prong (stippled, fig. 1 *A*). Labrum short, nearly twice as wide at base as median length. Base of labrum with dense patch of hairs directed along rostrum. Stridulatory comb of eleven pegs (fig. 1 *B*), each peg of approximately the same length. Chaetotaxy of male front leg as shown in figure 1 *C*.

Median leg in both sexes with an excavated area in basal half of first tarsal segment (fig. 1 *D*). Relative lengths of femur : tibia : tarsus I : tarsus II—fore leg, 100 : 100 : 55 : 0 ; middle leg, 100 : 75 : 42 : 22 ; hind leg, 100 : 83 : 32 : 32.

Female structural characteristics : viewed from above outline of head rounded with anterior width of vertex very slightly produced. Greatest width of head just under nine-tenths that of pronotal humeral and four and a half times as wide as anterior width of vertex. Along median longitudinal axis head nearly as long as pronotum. Pronotal humeral width nearly twice that of median length. Lateral margins divergent and just under half median length. Posteror margins convex and medianly emarginate. Relative lengths of femur : tibia : tarsus I : tarsus II—fore leg, 100 : 116 : 54 : 33 ; middle leg, 100 : 78 : 41 : 24 ; hind leg, 100 : 82 : 36 : 31.

Location of types : Holotype ♂, Ethiopia : Ogaden Province, between Guadere and Iet, 3.xii.1954 (*I. Lansbury*) ; allotype ♀, same data ; both in Hope Department of Entomology, Oxford. Paratypes, 3 ♂, 5 ♀, same data ; Ethiopia : Ogaden Province, 8 miles south of Guadere, 4.xii.1954, at light (*I. Lansbury*), 6 ♂, 5 ♀ ; Ethiopia : Ogaden Province, from tug between Guadere and Mustahill, 5.xii.1954, 3 ♂, 4 ♀ (*I. Lansbury*) ; Ethiopia : Ogaden Province, Guadere, 2.xii.1954, at light, 10 ♂, 8 ♀ (*I. Lansbury*) ; Kenya : Wajir, at light, 19.i.1955, 1 ♂ (*I. Lansbury*).

Comparative notes : This species resembles *A. worthingtoni* Jacz. It can be separated by the chaetotaxy of the male front leg and the excavated area of the first tarsal segment in both sexes. Data on distribution, known only by the type series.

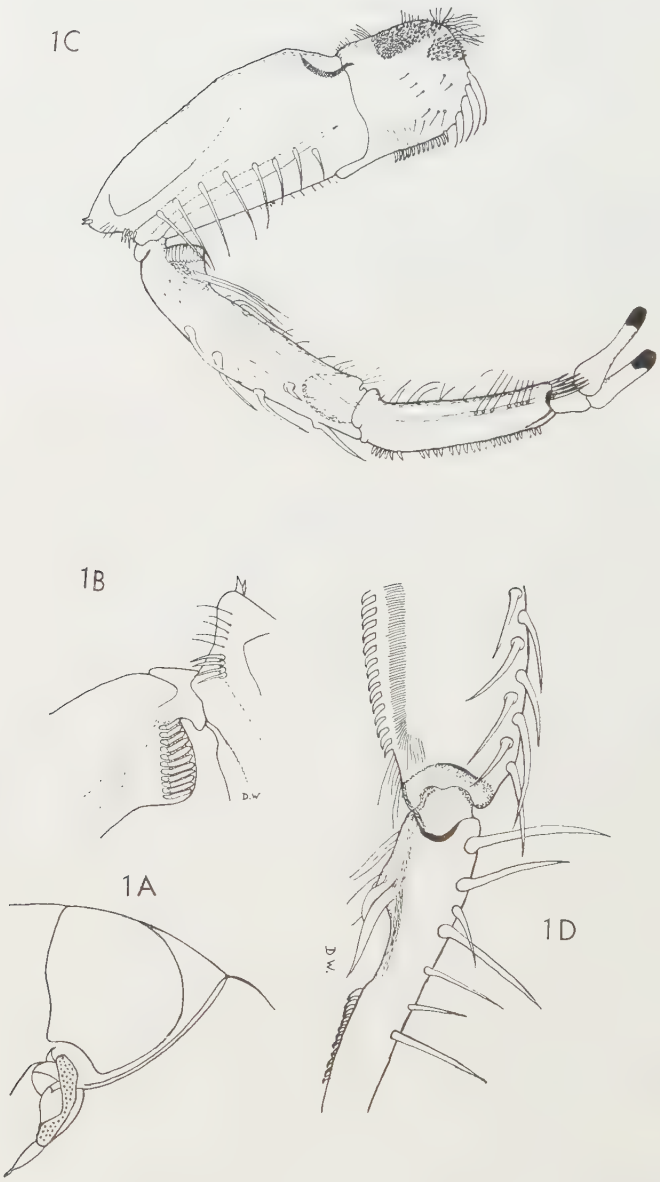

Fig. 1.—*Anisops spinosus* sp. n.: (*A*) head; (*B*) enlarged view of male fore tibia, showing stridulatory comb; (*C*) male fore leg, showing chaetotaxy; (*D*) median leg, excavated area of apical fifth of first tarsal segment.

A NEW SPECIES OF *MELIGETHES* STEPHENS FROM EAST AFRICA (COLEOPTERA : NITIDULIDAE)

By Alan M. Easton

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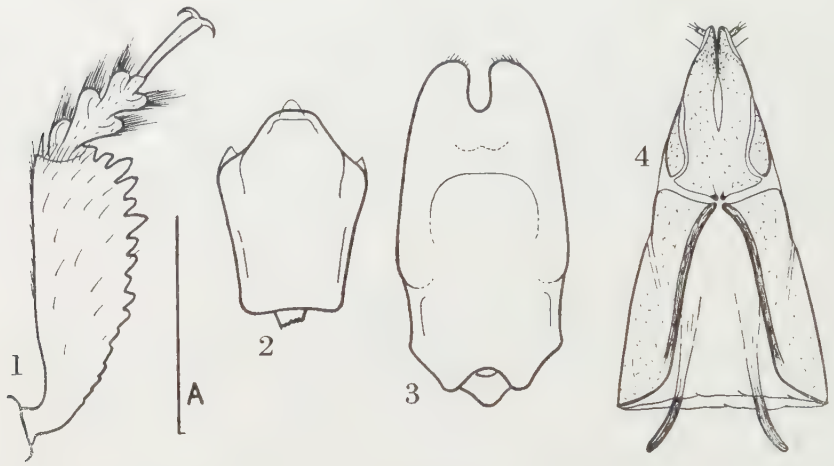
A small consignment of East African *Meligethes* was recently received for determination from Dr. Z. Kaszab, of the Hungarian National Museum. They had been collected in Tanganyika by Dr. Szunyoghy, and comprised *M. scotti* Easton (Tanga, 25–26.iii.1960, 6 ex.; Laiverero, 22.i.1960, 4 ex.) together with a pair of a new species, which is described below.

Meligethes suppar sp. n.

Male.—Length, 1·7; breadth, 1·05 mm. Elongate oval, somewhat rounded at sides, moderately strongly convex, black, somewhat shining, with recumbent silvery pubescence; legs pitchy reddish-brown. *Head* transverse, weakly convex; clypeus with anterior margin distinctly bordered, shallowly widely emarginate with side angles pointed; surface with punctures equal in size to eye facets, separated by less than half a diameter, spaces between them smooth. Antennae pitchy reddish-brown, first segment darker, second paler; club small, twice as wide, and one and a half times as long as first antennal segment. *Pronotum* less than twice as wide as long (0·95 : 0·6 mm.), widest at basal third, scarcely narrowed posteriorly; sides curving more strongly inwards in anterior half, very narrowly bordered, not explanate. Anterior margin straight for width of neck, curving forward at each end to the blunt obtuse front angles. Hind margin longer than front (0·9 : 0·6 mm.), feebly convex, weakly sinuate on either side of scutellum; hind angles obtusely pointed. Surface with punctures scarcely larger than eye facets, separated by one diameter, spaces between them almost smooth. *Elytra* slightly shorter than wide (0·95 : 1·05 mm.), widest at basal third; sides narrowly bordered, gently rounded, and convergent towards the widely rounded hind angles; apices weakly convex; sutural angles obtusely pointed. Shoulders feebly raised, without a humeral stria. Surface with shallow, slightly rugose, punctures, twice as large as eye facets, separated by one diameter or slightly less, spaces between them almost smooth. *Scutellum* transverse, with apex rounded; surface microscopically reticulate and with fine, somewhat close punctures. *Pygidium* with surface closely granulate. *Ventral surface* black. Prosternal process strongly broadened, twice as wide as antennal club, with apex subtruncate, sides bordered; surface with deep punctures equal in size to eye facets, separated by one and a half diameters, spaces between them smooth; punctures absent close to apex. Metasternum with punctures of similar size and spacing, surface between them smooth; without secondary sexual character. Abdomen with first sternite having punctures slightly smaller, shallower, and more diffuse, the succeeding segments much more finely and closely punctate and with surface reticulation. Caudal marginal line of hind coxal cavity following closely posterior edge of latter and turning back shortly before reaching its outer end. Very close to apex of last sternite is a narrow raised almost semicircular ridge, concave backward, its central anterior part less elevated, its width equal to that of antennal club. *Legs* pitchy reddish-brown. Front tibiae (fig. 1) twice as wide as antennal club; outer edge with minute irregular teeth from basal fourth, about four in a subapical group slightly larger and more prominent, and one near basal third indistinctly so; subtarsal plate not conspicuous. Intermediate and hind tibiae as wide as front; outer edge of former evenly rounded, of latter mostly so at apical fourth, furnished from basal third with short close downwardly directed pegs, finer and slightly longer on the hind tibiae. Inner edge of front tibiae almost straight, of intermediate weakly convex at basal third, of hind more strongly so; of intermediate and hind distinctly finely bordered. Front tarsi narrow, three-quarters as wide as antennal club; intermediate and hind less than half as wide; last segment slightly shorter than first four together; claws simple. *Genitalia* as figured (figs. 2 and 3). Tegmen rather strongly bent at shoulders, distal part somewhat elongate, with deep subparallel apical excision between

rounded lateral lobes; median lobe short, and much broadened at apical third, where a membranous projection is evident on each side on a more ventral plane.

Female.—More rounded at sides and slightly more convex than male, with apex of last ventral segment of abdomen simple; front tarsi scarcely narrower than in male. Ovipositor (fig. 4) brownish-yellow with apex piceous, somewhat pointed; with short styli very close to apex; outer subdivisions of coxites moderately broad; " central point " slightly nearer to apex, without a ventral spicule; transverse suture slightly angled as a flat V.



Figs. 1–4.—*Meligethes suppar* sp. n.: (1) right front tibia; (2, 3) aedeagus: (2) median lobe, dorsal view; (3) tegmen, dorsal view; (4) ovipositor, ventral view. Scale A = 0·25 mm.

Type ♂, Tanganyika: Nata, 15.ii.1960 (*Dr. Szunyoghy*); in the Hungarian National Museum, Budapest.

Paratype, one female with similar data to the type; in the author's collection.

Comparative notes.—The new species runs down to couplet 41 in the recently published key to the East African *Meligethes* (Easton, 1960). It is indeed very similar to *M. perfectus* Easton, and should apparently be included in the *perfectus* species-group. *M. suppar* is smaller, its pronotum is slightly more transverse, its elytra slightly less elongate and less narrowed posteriorly, its scutellum more sparsely punctate; its hind tibiae are slightly narrower, with their inner edge, at least in the female, less strongly convex at the basal third. The ovipositors differ in that the transverse suture is straight in *perfectus*, slightly angled in *suppar*. *M. imperfectus* Easton is again larger, and has much longer and more conspicuous pubescence; its ovipositor is entirely yellowish.

The median lobe of the aedeagus of *M. suppar* is reminiscent of those of *spissus* Grouv. and *kulalensis* Easton, as well as that of *curvipes* Grouv., though no close relationship to these species is suggested. In *suppar* the median orifice is apparently normally situated on the dorsal surface close to its apex.

Reference

Easton, A. M., 1960, The *Meligethes* of East Africa (Coleoptera: Nitidulidae). *Trans. R. ent. Soc. Lond.* **112**: 263–318, 127 figs.

TAXONOMIC NOTES ON *EPILACHNA INDICA* MULSANT AND DESCRIPTION OF A NEW SPECIES RELATED TO IT (COLEOPTERA : COCCINELLIDAE)

By A. P. Kapur

(*Zoological Survey of India, Calcutta*)

I. Introduction

Epilachna indica Mulsant was first described in 1850 by Mulsant from material from India in the collections of Reiche and Dejean. Crotch (1874) examined the type specimen belonging to Reiche's collection and recorded his observations on it. The specimen bearing the label " Type. *indica* Reiche ", since deposited in Crotch's collection at the University Museum of Zoology, Cambridge, England, may reasonably be regarded as the lectotype, according to our present-day conception of the status of such material. The present author had examined this example at Cambridge some years ago and has lately borrowed it for further study through the courtesy of Rev. C. E. Tottenham of Cambridge. In order, however, to avoid any doubt about the type status of this specimen, I have given it the " lectotype " label, as it is one of the two specimens from which Mulsant described the species. Examples in the collection of the Zoological Survey of India were compared with the above-mentioned specimen and found to be identical with it, inclusive of the structure of the male genitalia. It was thus possible not only to identify these correctly but to give an additional description of the species that included the structure of the female genitalia and to point out reliable distinguishing characters of the species.

Subsequent to Mulsant (1850) and Crotch (1874) mentioned above, a number of other authors have referred to the name *E. indica* but it seems from their writings that the correct identity of *E. indica* was perhaps not known to them. Weise (1900) recorded what he called *E. indica* from Ceylon, and described the new variety *ceylonica* Weise, in which two or more of the six spots were joined as follows : 5 + 3, 3 + 4, 5 + 3 + 4, 4 + 3 + 5 + 6. He further stated that the male genitalia of his material of *E. indica*, though somewhat shorter and slightly different in details, were similarly shaped to those of *Epilachna* 28-*punctata* (F.). An examination of the male genitalia of the lectotype of *E. indica*, referred to above, showed these to be robustly built and quite distinct from those of *E.* 28-*punctata*, which are less robust and have a distinct blade along the two-thirds of the upper ridge of the aedeagus ; the parameres and sipho are also very distinct in the two species. Besides, out of some 24 examples before me from India (all from N.E. India, *i.e.* Darjeeling, Assam and Sikkim), none showed confluence of the elytral spots, a character which appeared to be quite common in the material examined by Weise. Very probably he was referring to some other species. It may be mentioned here that, according to the more recent studies by Dieke (1947), *E. gangetica* Weise var. *connecta* Dieke, which is quite common in southern India, often shows such confluences of elytral spots as had been described by Weise.

Arrow (1900) was the next to record *E. indica*, this time from the Christmas Islands (Indian Ocean) but a subsequent examination of his material, deposited in the British Museum (Nat. Hist.), showed this to belong to a different species, more closely allied to *E.* 28-*punctata* than to *E. indica*, and probably new. Subramaniam

(1924) recorded what he called *E. indica* from Taliparamba in Malabar, S. India. I do not have access to his material but from a study of extensive material of *Epilachna* from southern India, I am doubtful of its occurrence in the south. At any rate, I have not come across this species from the south. Korschefsky (1931) recorded this species from Burma, from which country we also have an example in our collection. Korschefsky's (1934) record of this species from Annamalai Hills and other parts of the Madras district, as well as the record by Chatterji and Bose (1934) from the same localities based on an identification by Korschefsky, are incorrect, as an examination

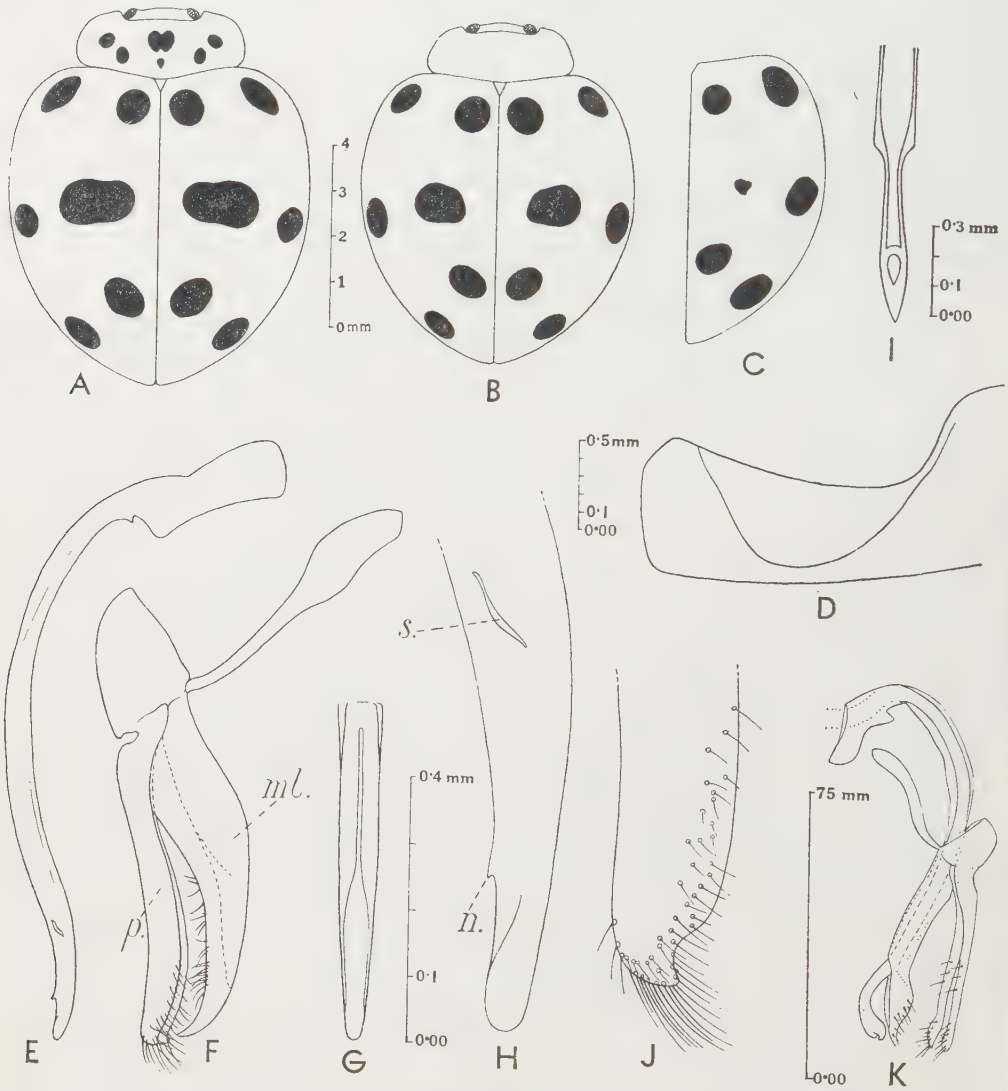


FIG. 1.—*Epilachna indica* Muls.: (*A–B*) outlines of the beetles showing variation in pattern in Indian examples; (*C*) the same in an example from Perak (Malaya); (*D*) abdominal line; (*E*) sipho; (*F*) other parts of male genitalia (*p*, parameres; *ml*, median lobe); (*G*) median lobe viewed from the front; (*H*) side view of apical part of sipho, much enlarged to show notch (*n*) and sigmoid mark (*s*); (*I*) front view of the same; (*J*) apex of paramere, much enlarged to show subapical emargination on the side; (*K*) male genitalia of *Epilachna chrysomelina orientalis* Zimm., figured by Pradhan (1935) as those of *E. indica*. (4·0 mm. scale for figures *A–C*; 0·5 mm. scale for figs. *D–G*; 0·4 mm. scale for figs. *H* and *J*; 0·3 mm scale for fig. *I*; 0·75 mm. scale for fig. *K*).

of the material at the Forest Research Institute, Dehra Dun, showed that these, too, did not belong to *E. indica* but to *E. gangetica* var. *connecta*.

In more recent years Pradhan (1935 ; 1937) has published papers on " The genitalia and their role in copulation in *Epilachna indica* . . . " and on " The alimentary canal of *Epilachna indica* (Coccinellidae ; Coleoptera) with a discussion on the activity of midgut epithelium." An examination of the description and figures of the male genitalia, published by Pradhan in his first-mentioned paper (1935 : 250–253, figs. 1–6) clearly shows that the species studied was not *E. indica* but *Epilachna chrysomelina* (F.) subsp. *orientalis* Zimmerman, which is distributed from the Middle East to northern India. An outline of the male genitalia, as given in figure 1 of Pradhan's (1935) paper, is reproduced in figure 1, *K* of the present paper, to show that these are like the male genitalia of *E. chrysomelina*. Pradhan's account in this paper and presumably also in his subsequent paper (1937), where *E. indica* has been mentioned, apparently refers to *E. chrysomelina orientalis* Zimm.

Dieke (1947) described *Epilachna tertia* Dieke from two male specimens, one each from Doom Dooma, Assam, and from Kurseong, northern Bengal. He also sketched its male genitalia. The descriptions and figures given by him agree with those of *E. indica*, and I believe that *E. tertia* Dk. is synonymous with *E. indica* Mulsant.

II. A Redescription of *Epilachna indica* Mulsant (figs. 1–2)

1850, *Epilachna indica* Mulsant, *Ann. Soc. Agric. Lyon* (2) **3** : 776–777 (Type loc., India).
1874, *Epilachna indica* Mulsant, Crotch, *Revision of Coccinellidae*. London, p. 84.
1947, *Epilachna tertia* Dieke, *Smithson. misc. Coll.* **106** (15) : 66, fig. 128, **syn. nov.**

Body distinctly larger, more rounded and convex than *Epilachna* 28-*punctata* (F.), generally testaceous to reddish-testaceous except the pale testaceous antero-lateral margins of pronotum, the black eyes, pronotal and elytral spots, and piceous to black metasternum. Pubescence greyish or dark brown, latter on black areas only. Pronotum with seven medium to small black spots, arranged as shown in figure 1, *A* or with reduced number of spots (6, 4 or 2) or without any spot, as in figure 1, *B*. Elytra with a total of 12 spots, the six spots on each elytron arranged as shown in figure 1, *A*, *B*. No. 1 spot, or the one near the scutellum, roundish, anterior margins almost level with or even slightly anterior to apex of scutellum ; spot no. 2, or the shoulder spot, situated right on the shoulder, and not touching the antero-lateral margin, both these spots rounded ; spot no. 3, or the median sutural spot, more distant from suture than either spot no. 1 or 5 and almost equidistant from both, usually larger (1·0–1·9 mm. wide, 0·6–1·2 mm. long) than the other spots, rectangular to moderately so, transverse ; spot no. 4, or the median lateral spot, situated almost on lateral margin, sub-transverse, equal to or a little larger than spot no. 1 or 2 ; the post-median spot near the suture, or spot no. 5, usually round and nearly same size as spot no. 1 or slightly larger, distinctly away from suture ; spot no. 6, or the subapical lateral spot, usually slightly larger than spot no. 5, a little transverse-oval in outline and not touching lateral margin. Size of spots variable but generally spot no. 3 the largest and transverse in position but in rare instances (2 examples from Perak, out of the 3 from Malaya) this spot is smaller than the others, as shown in figure 1, *C*. In the only example from Java the spots nos. 1 and 2 are larger and almost touch each other. It is not possible to say how far these are aberrant conditions in the species.

Underside testaceous excepting the dark brown to piceous median parts of metasternum and an irregular piceous patch at the middle of elytral epipleurae, level with spot no. 4 of the elytron.

Head distinctly transverse, with fine impressed and uniform punctation and thin, fairly close and greyish pubescence. Pronotum, when viewed flat from above, with anterior angles widely rounded, posterior angles obtuse and rounded, anterior margin nearly rectangularly emarginate in front, and lateral margins moderately rounded ; punctation similar to that on head, perhaps a little finer ; pubescence similar to that of head. Elytra distinctly convex, with anterior angle rounded and shoulder callus hardly distinct, lateral margins very narrowly, if at all, flattened, apical angle rounded and without any sharp angular point ; punctation double as in the genus, but with the finer punctures smaller and less impressed than those on pronotum ; pubescence grey except on the black spots where it is darker, otherwise similar to that on pronotum. Underside finely punctate, with thin and sparse pubescence, abdominal lines complete, reaching four-

fifths length of sternite (fig. 1, *D*); sixth abdominal sternite of male widely emarginate in the middle, while that of female, as usual for the genus (*sens. str.*), split longitudinally along the middle.

Male genitalia : sipho (fig. 1, *E*) moderately curved in basal three-fourths of length and from then on gradually curved in the opposite direction and gently narrowed to a rounded apex, provided with a sharp point or notch (fig. 1, *H*, *n*) a little distance before apex and a distinctive sigmoid mark (*s*) at about apical seven-eighths of length of the sipho, when seen from the side; viewed from the front it gives a lancet shaped appearance towards the apex (fig. 1, *I*), with a small oval orifice before apex. Parameres very slightly sigmoid in outline, each nearly uniformly wide along its length except very near apex where it is much narrowed, has its sharp point facing the median lobe, provided with short setae on inner side of apical one-third except near apex,

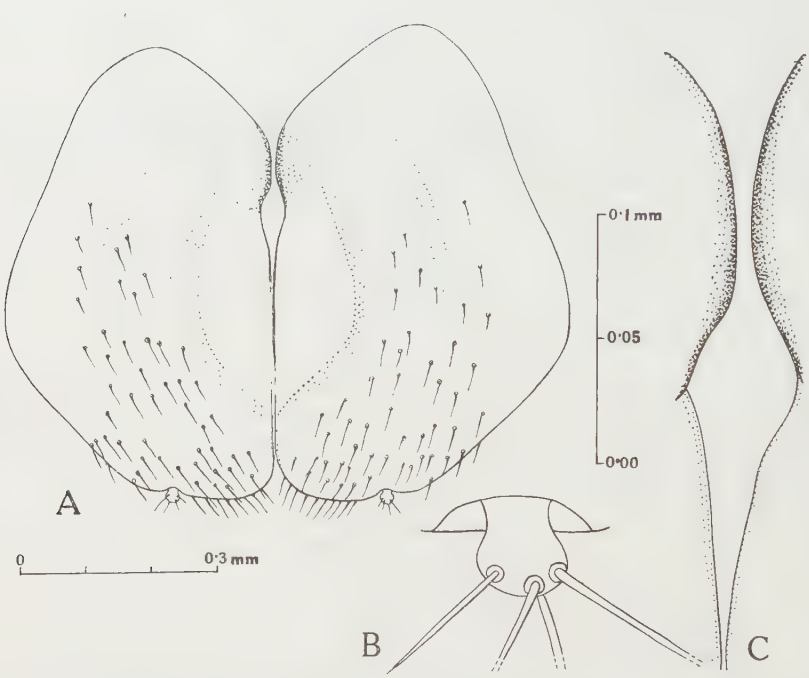


Fig. 2.—*Epilachna indica* Muls.; (*A*) female genital plates; (*B*) stylus; (*C*) emargination on inner margin of genital plates, much magnified. (0·3 mm. scale for fig. *A*; 0·1 mm. scale for figs. *B* and *C*.)

where setae increase both in number and length (fig. 1, *J*); median lobe when viewed from the side (fig. 1, *F*, *ml*) is also slightly sigmoid and nearly uniformly broad from base to about middle of its length, and gradually narrowed in the distal half to an almost pointed apex; provided with a number of short setae on surface facing the parameres; viewed from the front (fig. 1, *G*) it appears to be a relatively narrow tube, gradually narrowed further in distal half, also easily seen to be open along the middle, the opening being uniformly narrow in basal half and relatively widened in distal half.

Female genitalia : viewed together, the pair of female genital plates (ninth sternite) are relatively narrowed at base, widest at about middle and gradually rounded towards apex, each plate nearly straight along inner margin, opposing each other and provided with a longish emargination a little distance below base (fig. 2, *C*); margin from base to emargination strongly chitinised; a small, pear-shaped stylus (fig. 2, *B*), bearing about four longish setae, is also present in middle of apical margin of each genital plate. Outlines of genital plates, and of emargination on inner margin and shape and position of stylus rather characteristic of female genitalia of the species, and greatly help in its identification.

Length : 6·6–8·2 mm.; *width :* 5·5–6·6 mm.

Material examined : Besides the lectotype mentioned above, 30 specimens were examined from the following localities : (British Museum (Nat. Hist.) material is indicated by the initials B.M.)

India : Northern West Bengal, Singla, 1500 ft., Darjeeling district, v.1913, 2 ; vi.1913, 2 ; Darjeeling district (without exact locality), v.1913, 6 ; vi.1913, 6 ; Birch Hill (6000–7000 ft.) Darjeeling dist., 4.vii.1914, 1 (all *Lord Carmichael* coll., in Zoological Survey of India). Assam, Naga Hills, 1 ; Manipur, 1, B.M. (*Doherty* coll.).

Sikkim : Mungphu, 2 (*E. T. Atkinson* col.) ; Sikkim (without exact locality), 1. (*Doherty* coll.) ; Dikchu, 542 m. 14.viii.1959, 1 (*A. G. K. Menon* coll.).

Burma : Upper Burma, Sadon, 400 ft., iv.1911, 1 (*E. Colenso* coll.).

China : (without exact locality) (*Dr. Cantor* coll., 1 ex. from the late Museum East India Co., in Z.S.I.).

Federated Malay States : Perak, 2, B.M. (*Doherty* coll.) ; F.M.S., 1909, 1, B.M. (*C. J. Brooks* coll.).

Java : (without exact loc.), 1, B.M. (*Bowring* coll.).

Remarks : In external appearance the species resembles certain other 12-spotted species of the genus *Epilachna*, such as *E. dodecastigma* (Wied.) (the 12-spotted variety), *E. pytho* Muls., *etc.*, but is distinctly more orbicular and generally larger in size than any of them. Besides, its spot no. 3 is generally the largest and usually transversely placed ; exceptions to this character may, however, be noticed, as in the case of the material from Perak mentioned above. It is also easily distinguished from other 12-spotted species by the shape of the male and female genitalia, especially in the larger size of the median lobe of the male genitalia. In this character it bears a superficial resemblance to *E. ocellata* Redt., another 12-spotted species, which is, however, a little smaller and less convex and has light ocellations round each elytral spot. In details of the structure of both the male and female genitalia also, the two species are easily separated.

E. indica is closely related to the new species, *E. karenensis* from Burma, described below, but the two can be easily distinguished by the external characters as well as the structure of the genitalia (*see* remarks under *E. karenensis*).

Practically nothing is known with certainty of the feeding habits of *E. indica* and earlier records of its food plants, *etc.*, may be accepted with reservation owing to doubtful determinations.

III. Description of the New Species

Epilachna karenensis sp. n.

Body almost similar in appearance and size to *Epilachna indica* Mulsant, but slightly narrower posteriorly. In coloration also similar, except for the following noteworthy differences : lateral pair of black spots on pronotum larger and subquadrate ; median two spots in one example and median three in the other example, confluent ; elytral spots occupying the same positions as in *E. indica* but distinctly larger and mostly subquadrate in outline (fig. 3, *A*). Front tangent of spot no. 1 distinctly below apex of scutellum, spot extended to suture, appearing to be confluent with spot opposite, on other elytron, placed rather obliquely in the direction of spot no. 4 ; spot no. 2 slightly larger, not rounded, rather subtriangular, and not touching the anterolateral margin ; spot no. 3 larger (1·8–2·0 mm. wide) than the preceding two, subquadrate, transverse and distinctly away from the suture ; spot no. 4 a little larger in area than spot no. 3, nearly as wide but longer and touching lateral margin of the elytron ; spot no. 5 subcircular, larger than spots 1 and 2, almost touching the suture ; spot no. 6 nearly as large as spot no. 5, subquadrate and not touching the lateral margin. Underside testaceous as in *E. indica* but with median sclerites of both meso- and metasternum black.

Head and pronotum similar to those of *E. indica*. Abdominal lines complete, similar to those in *E. indica*.

Male genitalia : Sipho (fig. 3, *E*, *H*) almost like that of *E. indica* but more pointed at apex and devoid of the sigmoid mark, so characteristic of the latter species. Paramere (fig. 3, *F*, *p* ; *G*) distinctly narrowed in apical one-third, each with pointed apex directed towards median lobe and with a few short setae in distal one-third, except near apex where setae increase both in number and size. The outline of the parameres affords a reliable distinguishing character by which the two species can be easily separated. Median lobe (fig. 3, *F*, *ml*) almost similar to that of

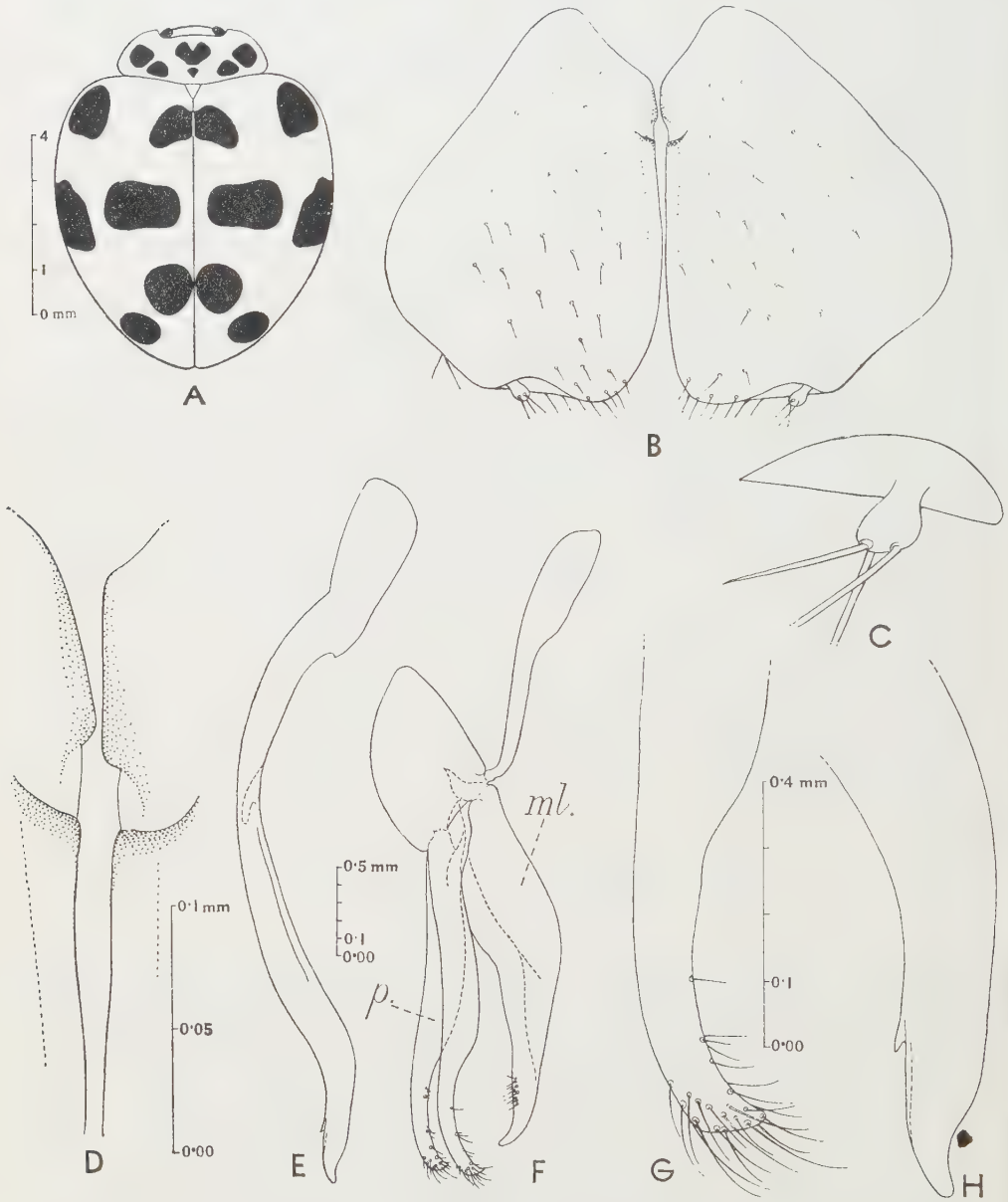


FIG. 3.—*Epilachna karenensis*, sp. n. ; (*A*) body outline and colour pattern ; (*B*) female genital plates ; (*C*) stylus ; (*D*) oblique emargination on inner margin of genital plates, much enlarged ; (*E*) sipho of male genitalia ; (*F*) other parts of male genitalia (*p*, parameres ; *ml*, median lobe) ; (*G*) apical half of paramere, much enlarged ; (*H*) apex of sipho, much enlarged. (4·0 mm. scale for fig. *A* ; 0·4 mm. scale for figs. *B*, *G* and *H* ; 0·1 mm. scale for figs. *C* and *D* ; 0·5 mm. scale for figs. *E* and *F*).

E. indica but distinctly narrower apically and with only a small group of short setae at a little distance before the apex.

Female genitalia : The female genital plates (ninth sternite) narrower at base (fig. 3, *B*) than those of *E. indica*, plates widest at about two-thirds of their length, with an elongate but oblique emargination on inner margin, near the base (fig. 3, *D*) ; the styli (fig. 3, *C*) also relatively narrower than those in *E. indica*.

Length : 7·3 mm. (holotype) ; 7·6 mm. (allotype). *Width :* 6·5 mm. (holotype) ; 6·5 mm. (allotype).

Holotype ♂, Burma : Karen Mountains (*Doherty* coll.), in the British Museum (Nat. Hist.) London.

Allotype ♀, Burma, with the same data as the holotype ; in the Zoological Survey of India.

The genitalia in both cases are mounted in Canada Balsam between two coverslips and pinned with the respective specimen.

Remarks : As is evident from the general shape, the number and position of markings, and the structure of the genitalia, *E. karenensis* is closely allied to *E. indica* Mulsant, which also occurs in Burma. The two can, however, be easily distinguished by the size and shape of the elytral spots, by the rounded (*E. indica*) or pointed (*E. karenensis*) apex of each elytron, and the shape of the male genitalia and of the female genital plates, as already described and compared in the two species.

IV. Summary

The identity of *Epilachna indica* Mulsant, which seemed to have been confused with certain other species of the genus in some of the earlier literature on the subject has been established on the basis of a detailed examination of the lectotype. A redescription of the species, based on a longer series of examples of the species, from north-eastern India, Sikkim and Burma, *etc.*, is given. It appears that the geographical distribution of the species extends from north-eastern India to Burma, China, Malaya and Java.

A new species, *Epilachna karenensis* Kapur, is described from the Karen mountains in Burma. It is allied to *E. indica* in general shape and size, but can be distinguished from the latter in details of coloration and other structures, including those of the male and female genitalia, which are described and compared in the two species.

V. Acknowledgments

My sincere thanks are due to Rev. C. E. Tottenham of the University Museum of Zoology, Cambridge, for the loan of the type material of *E. indica* Mulsant from the Crotch collection, and to Mr. N. D. Riley, formerly Keeper of Entomology, British Museum (Nat. Hist.), for the loan of certain *Epilachna* material for study, out of which some of the examples have been noted in this paper. I am also much obliged to Dr. M. L. Roonwal, Director of the Zoological Survey of India, for taking interest and affording facilities for the present study.

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